UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/873,706 | 06/04/2001 | Sridhar Gollamudi | 3 | 4965 |

46290 7590 05/19/2008
WILLIAMS, MORGAN & AMERSON
10333 RICHMOND, SUITE 1100
HOUSTON, TX 77042

| EXAMINER | |
|---|---|
| PERILLA, JASON M | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2611 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 05/19/2008 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. 09/873,706 | Applicant(s) GOLLAMUDI, SRIDHAR | |
|---|---|---|---|
| | **Examiner** JASON M. PERILLA | **Art Unit** 2611 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *18 February 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 June 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

## DETAILED ACTION

1. Claims 1-13 are pending in the instant application.

### *Response to Arguments/Amendments*

2. The Applicant's remarks, filed February 18, 2008, have been considered, but they are not persuasive.

Regarding the Applicant's arguments against the prior art combination Harrison (U.S. Pat. No. 6154485) in view of Forssen et al (US 6173014; "Forssen"), the Applicant suggests that "neither of these references is concerned with using correlations between signals transmitted by a first set of antennas to determine the relative amounts of orthogonal coding and beamforming used to transmit signals from a different set of antennas to the first set of antennas." However, as applied in the rejection below, Harrison discloses the first set of antennae (fig. 1, refs. 116 and 118) and second antenna (fig. 1, ref. 120). In the combination, Harrison's first set of antennae correlates signals (which were transmitted by second antenna 120) received between the individual antenna 116 and 118 as taught by Forssen. Thereafter, the correlation leads to the determination of relative amounts of orthogonal coding and beamforming used to transmit signals back to the second antenna 120. The Applicant further states that "[i]n particular, the cited references don't describe using correlations between pilot signals . . . . " However, correlation between ***pilot*** signals is not claimed in independent claim 1.

With respect to the newly amended claims 2, 3, and 5, new grounds of rejection are set forth below.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harrison (U.S. Pat. No. 6154485 – cited in IDS) in view of Forssen et al (US 6173014; "Forssen" – previously cited).

Regarding claim 1, Harrison discloses a method of transmitting signals from at least two first antennae (fig. 1; refs. 116, and 118) comprising the steps of: determining at least one second correlation coefficient (α; col. 7, lines 50-52) from feedback signals received by (or "sent back to"; col. 4, line 35) the two first antennae (col. 4, lines 28-35) and transmitted from at least one second antenna (fig. 1, ref. 120); and in response to the at least one second determined correlation coefficient, selecting at least one of orthogonal coding and beamforming for transmitting signals using the at least two first antennae (fig. 5; col. 8, lines 4-35). The correlation coefficient α utilized in figure 4 is a correlation coefficient because it determines the amount correlation between the two signals 108 and 110 respectively transmitted from the two antennae. Harrison discloses that the second coefficient is determined according to the received feedback signal (col. 4, lines 28-35) which is (necessarily) transmitted by second antenna 120 of unit 56 to the at least two antennae 116 and 118 of unit 52. Harrison does not explicitly disclose that (1) the feedback signals are used to determine at least one first correlation coefficient being indicative of at least one correlation between signals received by the at

least two first antennae and (2) that the second coefficient is based upon the first coefficient. . However, Forssen teaches, in a multiple antenna system (fig. 5, refs. 270A and 270B), that cross-correlation between the same signal received between different antennas can be performed to determine instantaneous impairment properties between the two antennas (col. 7, lines 14-19). Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize the cross-correlation technique of Forssen in the method of Harrison because it could be utilized to determine impairment properties between the "at least two" signals received by the respective first two antennae such that the second correlation coefficient could be adjusted to aid in the transmission of signals. As broadly as claimed, any determined value of the cross correlation of Forssen is considered to be a "first coefficient" and is "indicative of" a correlation between the signals received by the antennae. Furthermore, in the combination of Harrison in view of Forssen, Harrison's second coefficient is determined according to the Forssen's cross correlation of signals received by the two antennae. Therefore, Harrison's second coefficient is "based" on the first coefficient.

Regarding claim 2, Harrison in view of Forssen disclose the limitations of claim 1 as applied above. Further, Harrison discloses that the step of determining at least one correlation coefficient between the received signals comprises determining at least one amplitude correlation coefficient (fig. 5). The coefficient $\alpha$ of figure 5 determines the amplitude correlation of the various input signals for transmission (fig. 5, refs. 72 and 74) to the various antenna by the weight multipliers (fig. 5, refs. 172 and 176) by the

function $(1-\alpha^2)^{1/2}$. Therefore, the correlation coefficient determines at least one amplitude correlation coefficient. Harrison in view of Forssen disclose that the first coefficient is based on the signal transmitted by the second antenna (120) and received by the two first antennae (116 and 118) but do not explicitly disclose that the signal is a *pilot* signal. However, the fact that the Harrison's unit 56 returns feedback to Harrison's unit 52 is clear (col. 4, line 35). Moreover, it is noted that, when Harrison transmits signals from unit 52 (with the two first antennae) to be received (with second antenna 120) by unit 56, pilot signals (fig. 1, P0 and P1) are inserted to permit unit 56 to "compute complex conjugate impulse responses of individual channels from elements 116 and 118" (col. 4, lines 5-10). In view of Harrison's descriptive teaching of using pilot signals for determining channel responses from unit 52 to unit 56, it would have been obvious to one having ordinary skill in the art at the time which the invention was made that the unit 56 could insert pilot signals in signals transmitted to unit 52 because it would aide in the determination of a channel response at unit 52 from antenna 120. With such modification, the application of Forssen would be understood by one having ordinary skill in the art to correlated received pilot signals.

Regarding claim 3, Harrison in view of Forssen disclose the limitations of claim 1 as applied above. Harrison discloses determining at least one correlation coefficient, but does not disclose that the step of determining at least one correlation coefficient comprises determining at least one phase correlation coefficient. The correlation coefficient of Harrison, $\alpha$, is used to control the relative amount of beamforming to orthogonal coding used in the transmission (col. 8, lines 4-35). It is purely a real value

having amplitude but not phase correspondence. However, one skilled in the art is familiar with adaptive beamforming and the use of phase adjustments applied to signals for the various antenna facets used in the transmission of a beamformed signal. Forssen teaches an adaptive beamforming system (fig. 4). Forssen also discloses that various phase shifts are made to the signals being applied to the various antenna facets to create a beam (col. 5, line 60-col. 6, line 17; *col. 6, lines 4-6*). Thereby, with the use of amplitude *and phase* information applied to the various signals transmitted to create a beam, the downlink carrier-to-interference ratio is improved. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to determine a phase correlation coefficient as taught by Forssen in the method of Harrison in view of Forssen because the phase information can be advantageously utilized to create the adaptive beam which results in a lower carrier-to-interference ratio on the downlink. Finally regarding claim 3, the insertion of pilot signals in signals transmitted by unit 56 on the second antenna 120 is obvious as applied to claim 2 above.

Regarding claim 4, Harrison in view of Forssen disclose the limitations of claim 3 as applied above. Further, as broadly as claimed, it is necessary that the at least one phase correlation coefficient α of Harrison's figure 5 is estimated because it is generated from the channel feedback (fig. 1, ref. 149; col. 5, line 65-col. 6, line 6).

Regarding claim 5, Harrison in view of Forssen disclose the limitations of claim 1 as applied above. Further, in the combination of Harrison in view of Forssen, determining the at least one correlation coefficient comprises determining at least one

correlation between received signals because Forssen discloses correlating the signals received at antennae 116 and 118. Finally regarding claim 3, the insertion of pilot signals in signals transmitted by unit 56 on the second antenna 120 is obvious as applied to claim 2 above.

Regarding claim 6, Harrison in view of Forssen discloses the limitations of claim 1 as applied above. Further, Harrison discloses that the step of selecting at least one of orthogonal coding or beamforming comprises selecting a proportion of orthogonal coding relative to a proportion of beamforming of the transmitting signals (col. 8, lines 4-35).

Regarding claim 7, Harrison in view of Forssen disclose the limitations of claim 6 as applied above. Further, Harrison discloses that the at least one correlation coefficient varies between a first level and a second level (col. 7, lines 59-61).

Regarding claim 8, Harrison in view of Forssen disclose the limitations of claim 13 as applied above. Further, Harrison discloses that the at least one correlation coefficient having a level between the first and second levels results in selecting both beamforming and orthogonal coding for transmitting (col. 8, lines 22-35).

Regarding claim 9, Harrison in view of Forssen disclose the limitations of claim 13 as applied above. Further, Harrison discloses that the at least one correlation coefficient determines the proportion of beamforming relative to orthogonal coding used for transmitting (col. 8, lines 4-35).

Regarding claim 10, Harrison in view of Forssen disclose the limitations of claim 9 as applied above. Further, Harrison discloses that the at least one correlation

coefficient being at a level that is closer to the first level results in transmitting more beamforming than orthogonal coding (col. 8, lines 4-35).

Regarding claim 11, Harrison in view of Forssen disclose the limitations of claim 9 as applied above. Further, Harrison discloses that the at least one correlation coefficient being at a level that is closer to the second level results in transmitting using more orthogonal than beamforming (col. 8, lines 4-35).

Regarding claim 12, Harrison in view of Forssen disclose the limitations of claim 9 as applied above. Further, Harrison discloses that the at least one correlation coefficient relative to the first and second reference levels determines the relative amounts of beamforming relative to orthogonal coding used for transmitting (col. 8, lines 4-35).

Regarding claim 13, Harrison in view of Forssen disclose the limitations of claim 7 as applied above. Further, Harrison discloses that the at least one correlation coefficient being substantially equal to the first level results in selecting beamforming for transmitting and wherein the at least one correlation coefficient being substantially equal to the second level results in selection orthogonal coding for transmitting (col. 8, lines 4-35).

***Allowable Subject Matter***

5. No claims are allowed.

***Conclusion***

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP §

706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to JASON M. PERILLA whose telephone number is (571)272-3055. The examiner can normally be reached on M-F 8-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chieh M. Fan can be reached on (571) 272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jason M Perilla/
Primary Examiner, Art Unit 2611
May 14, 2008

/jmp/

/CHIEH M FAN/
Supervisory Patent Examiner, Art Unit 2611